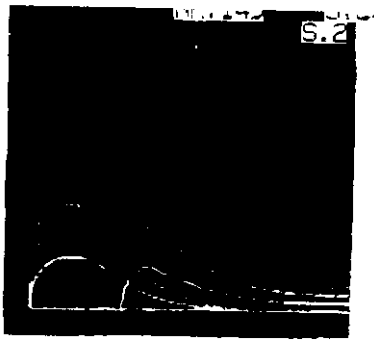
PHOENIX TEST-LAB

Testing body:	PHOENIX TEST-LAB Königswinkel 10 D-32825 Blomberg
Applicant:	ELSA AG Sonnenweg 11 D-52070 Aachen
Manufacturer:	applicant
Order number:	90269
Type of test:	Radio-Noise Emission of Information Technology Equipment (ITE):

Method of measurement according to:	- ANSI C63.4 dd. 1992
Limits and requirements according to:	- CISPR 22 Class B dd. 1993-12 - FCC Part 15.109



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Equipment under test (Microlink Cable):	cable modem
Type identification:	Microlink Cable
Serial number:	352800000002
FCC ID:	XJGMLCABLE
Client:	applicant
Date equipment was received:	14.07.1999
Annex:	Photos of the test setups and the test subject Block diagram with all operating frequencies Statement to incorporate EMC modifications
Applicant/Client represented during the test by the following person(s):	Mrs. Soheyar
Place of test:	PHOENIX TEST-LAB Blomberg, Germany
Date of test:	14.07.1999
Test result:	The requirements made in the test documents were fulfilled by the equipment under test. The complete test results are present in the following.

Blomberg, 09. July 1999

Examiner: Thomas Weiseking

ELSA AG
Sonnenweg 11 · D-52070 Aachen
Tel. +49- (0)241 - 606 - 0
Fax +49-(0)241 - 606 - 1199

Applicant

Laboratory Director: D. Pelz

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Contents: **Page**

1 Operational conditions and test set-up

The following states were defined as the operating conditions:

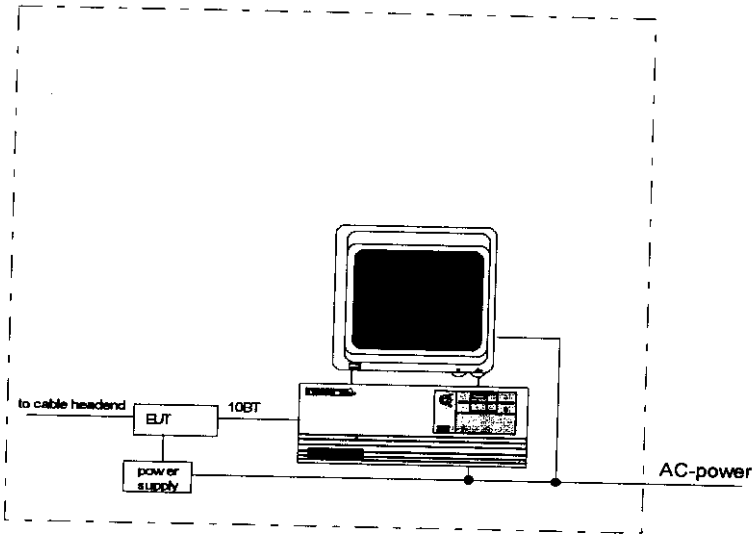
- The graphic board has two different operation conditions, wich are not available at the same time. This test report contains the operation condition with a TV-monitor.

- As test computer we used the following equipment:

PC:	Packard Bell
	DUG03-M7X6-SEA
	Test Number GE-AK04/9932-fc
keyboard:	Hewlett Packard Part #: C3758-60203
	Product #: C3758A ABD
	FCC ID: CIGEØ3633
mouse:	Hewlett Packard
	serial no.: LZB64208399
	FCC ID: DZL211Ø29
monitor:	Elsa type GDM-17E03T5
	serial no.: 6302392
	FCC ID: AK8GDM17SE2T

As operating system we used Windows 98. On both interfaces of the EUT a TCP/IP-ping was used.
The line voltage was 120VAC and the line frequency was 60Hz.

The system was set up as follows:

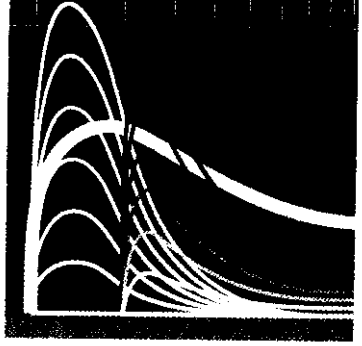


- test configuration for table top equipment radiated emissions according to fig. 9(c) and fig. 11, ANSI C63.4 dd. 1992
- test configuration for table top equipment conducted emissions according to fig. 9(a) and fig. 11, ANSI C63.4 dd. 1992

The following external I/O cables were used:

Name of cable	length	shielding	connectors
tv cable	2.0m	yes	f
ethernetcable	2.0m	yes	rj45

Special EMC modifications:
none



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2 List of test procedures and summary of results

Radiated Emission					
No	Frequency range	Limits	Basic standard	Remark	Status
1	30 to 230 MHz 230 to 1000 MHz	30 dB(µV/m) in 10m 37 dB(µV/m) in 10m	CISPR 22, Class B ITE	Residential area	fulfilled
1	1000 to 2000 MHz	54 dB(µV/m) in 3m	FCC Part 15.109, Class B ITE	Residential area	fulfilled
-	30 to 230 MHz 230 to 1000 MHz	40 dB(µV/m) in 10m 47 dB(µV/m) in 10m	CISPR 22, Class A ITE	industrial area	-
-	1000 to 2000 MHz	59.5 dB(µV/m) in 3m	FCC Part 15.109, Class A ITE	industrial area	-

AC Powerline Conducted Emission					
No	Frequency range	Limits	Basic standard	Remark	Status
2	0.15 to 0.5 MHz 0.5 to 5 MHz 5 to 30 MHz	66 to 56 dB (µV) Q 56 to 46 dB (µV) M 56dB (µV) Q 46dB (µV) M 60dB (µV) Q 50dB (µV) M	CISPR 22, Class B ITE	Residential area	fulfilled
-	0.15 to 0.5 MHz 0.5 to 30 MHz	79 (µV) Q 66 (µV) M 73dB (µV) Q 60dB (µV) M	CISPR 22, Class A ITE	industrial area	-

3 Measurement Procedure and Data

3.1 Radiated Emission Test

Test equipment:

FAC-controller HD100 (PM No. 480181)
FAC-antenna mast (PM No. 480188)
FAC-turntable (PM No. 480186)
Fully anechoic chamber (PM No. 480179) meets the ± 4 dB requirements of ANSI C63. 4 above 100MHz up to 5GHz
OATS-controller HD100 (PM No. 480139)
OATS-antenna mast (PM No. 480086)
OATS-turntable (PM No. 480087)
Open area test site (PM No. 480021) meets the requirements of ANSI C 63.4
ESMI test receiver (PM No. 480179) meets the requirements of CISPR 16

EMI-software package ES-K1 (PM No. 480111)
AC filter (PM No. 480100)
CBL6112 Bi.Log. antenna(PM No. 480185) meets the requirements of ANSI C 63.2 /1987

All measuring equipment underlie a quality system and are calibrated

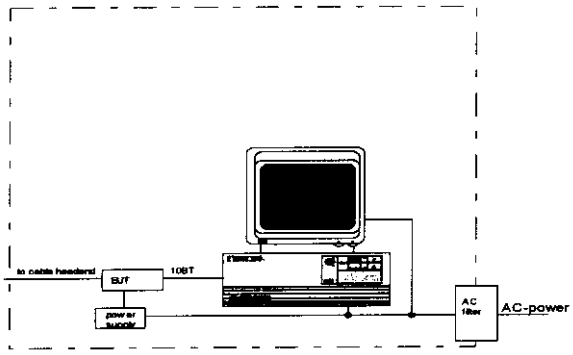
The test equipment is manufactured by the company Rohde & Schwarz.

Measuring records: The measuring records are presented on the following pages.

3.1.1 Preliminary Radiated Emission Test

Test set-up: In accordance to ANSI C63.4 dd. 1992. fig. 9(c) and fig. 11

The following drawing schematically shows the cable configuration for the fully anechoic chamber.



Preliminary measurements are made in a fully anechoic chamber (FAC) with 3m measuring distance. Here the equipment under test is in the first step measured from two sides in its normal fitted position with both polarization's of the antenna. This scan uses the scantable for preliminary measurements. This procedure makes it possible to ascertain without the effect of external interference sources and without adjusting the antenna in height whether the test object is emitting interference at certain frequencies.
In the second stage the frequency range, with the results from the first step, is divided into six ranges. In each range the six frequencies with the highest level, which are closer than 10dB to the limit line, are measured with the receiver setup shown in the scan table for the search scan and with both polarization's for the antenna. In this case the turntable is moved by 2 degree steps over 360 degrees. In the last stage the positions with the highest levels are measured with the quasi-peak detector or, above 1GHz with the average detector. These frequencies, below 1GHz, will be used for the final measurement on the open area test site. The measurements above 1GHz in the FAC are the final measurements results.

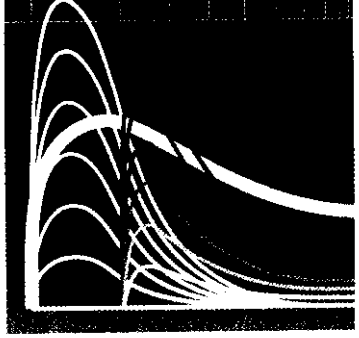
1st header line	Preliminary measurement on a 3m distance with
2nd header line	ESMI receiver by ROHDE&SCHWARZ
EUT	MicroLink Cable
Manufacturer	ELSA AG
Operating Condition	registriert and ping
Test Site	PHOENIX TEST-LAB fully anechoic chamber M8
Operator	Th. wedeking
Test Specification	
Comment line	According to ANSI C63.4 dd 1992
	14.07.1999 / 9:35:04

SCANTABLE for the preliminary measurement: FCC F M8

Unit:	dBµV/m	
	Detector:	Mode:
Curve1:	MaxPeak	ClearWrite
Curve2:	Average	ClearWrite

Subrange 1 and 2:

Start frequency:	30.0 MHz	Increment:	80.0 kHz
Stop frequency:	250.0 MHz		
Measurement time:	20.0 ms		
IF-bandwidth:	120 kHz		
Start frequency:	250.0 MHz	Increment:	80.0 kHz
Stop frequency:	1.0 GHz		
Measurement time:	20.0 ms		
IF bandwith:	120 kHz		
Receiver:	ESMI	Probe transducer:	_CBL 6112
Signal path:	ANT_RFIN_HF	System transducer:	ANT_5GHz
Scan-mode:	Lin		
Tracking-gen.:	Off		
Input:	2DC		
Preamplifier:	10 dB	Demodulation:	AM
RF-attenuation:	0 dB		
Ref.-level:	-70.0 dBm		
Min. RF-attenuation:	0 dB		
IF. attenuation:			
Auto range:	On		



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Subrange 3:

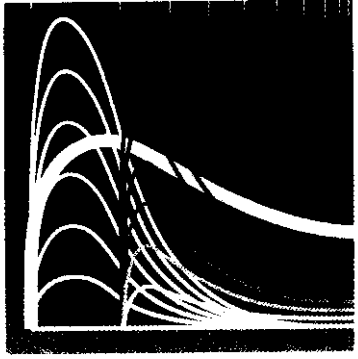
Start frequency:	1.0 GHz	Increment:	600.0 kHz
Stop frequency:	2.0 GHz		
Measurement time:	20.0 ms		
IF-bandwidth:	1 MHz		
Receiver:	ESMI	Probe transducer:	_CBL 6112
Signal path:	ANT_RFIN_HF	System transducer:	ANT_5GHz
Scan-mode:	Lin		
Tracking-gen.:	Off		
Input:	2DC		
Preamplifier:	10 dB	Demodulation:	AM
RF-attenuation:	0 dB		
Ref.-level:	-70.0 dBm		
Min. RF-attenuation:	0 dB		
IF. attenuation:			
Auto range:	On		

SCANTABLE for the search scan: FCC F M8 QP/PK_fin

Unit:	dBµV/m	
	Detector:	Mode:
Curve1:	MaxPeak	ClearWrite
Curve2:	Average	ClearWrite

Subrange 1:

Start frequency:	30.0 MHz	Increment:	12.0 kHz
Stop frequency:	1.0 GHz		
Measurement time:	100.0 ms		
IF bandwidth:	120 kHz		
Receiver:	ESMI	Probe transducer:	_CBL 6112
Signal path:	ANT_RFIN_HF	System transducer:	ANT_5GHz
Scan-mode:	Lin		
Tracking gen.:	Off		
Input:	2DC		
Preamplifier:	10 dB	Demodulation:	AM
RF attenuation:	0 dB		
Ref. level:	-70.0 dBm		
Min. RF attenuation:	0 dB		
IF attenuation:			
Auto range:	On		



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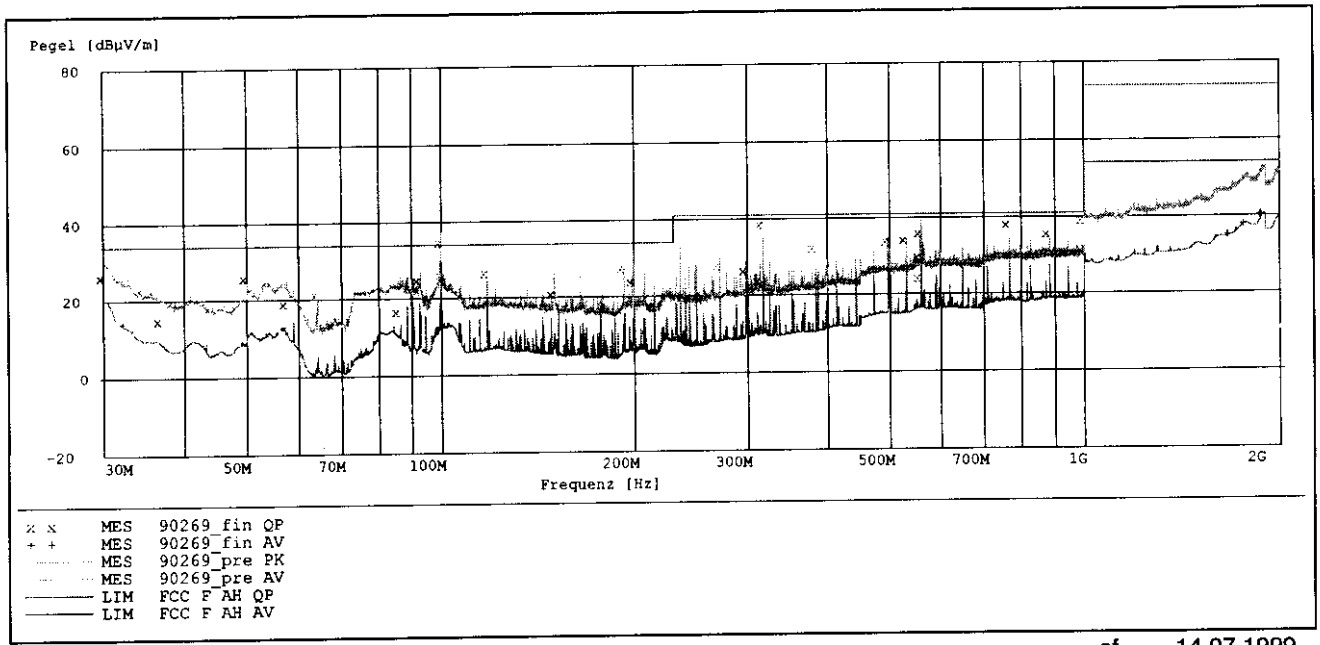
Subrange 2:

Start frequency:	1.0 GHz	Increment:	100.0 kHz
Stop frequency:	2.0 GHz		
Measurement time:	100.0 ms		
IF bandwidth:	1 MHz		
Receiver:	ESMI	Probe transducer:	_CBL 6112
Signal path:	ANT_RFIN_HF	System transducer:	ANT_5GHz
Scan mode:	Lin		
Tracking gen.:	Off		
Input:	2DC		
Preamplifier:	10 dB	Demodulation:	AM
RF attenuation:	0 dB		
Ref. level:	-70.0 dBm		
Min. RF attenuation:	0 dB		
IF attenuation:			
Auto range:	On		

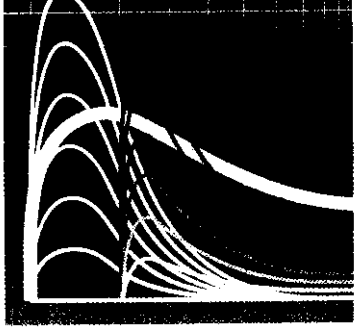
The measurement time with the quasi-peak, max-peak and average detector is 1 second for the last stage

The limit line and measurement curve shown in the diagram below refer to the preliminary measurements. Here, it must be noted that because of the reduced measuring distance (3m instead of 10m) and the floor absorbers, the measured values do not comply with the values of the above mentioned standard; they only serve as orientation in determining which frequencies must be measured on the open area test site.
The limit line is achieved with the applied standard by converting to a 3m measurement distance (+10 dB) and the correction for the free space in which in the "worst case" the reflected floor wave is missing entirely (-6dB). Therefore 4dB is added to the limit line of the standard concerned.
The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with the EUT in various positions.
For frequencies ≤1GHz:
The top measured curve represents the peak measurement. The measured points marked with x are frequency points of the highest emissions relativ to the limit, for which in the next step measurements with a quasi-peak detector on the open area test side were carried out. These values are indicated in the following table. The bottom measured curve represents average values, which are only required for control purposes.
For frequencies >1GHz:
The top measured curve represents the peak measurement. The measured points marked with x are the final measured max-peak results. These values are indicated in the following table. The bottom measured curve represents average values. The measured points marked with + are the final measured average results



Data record name: 90269

of 14.07.1999



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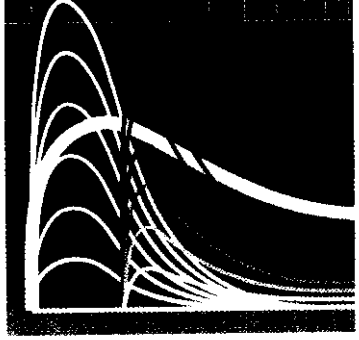
Result measured:
≤1GHz with quasi-peak detector
>1GHz with max-peak detector
(These values are marked in the above diagram by x)

Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Exceed Mark	Height	Azimuth	Polarisation
30.036000	26.17	34.00	7.83		150.0	24.00	VERTICAL
36.816000	14.83	34.00	19.17		150.0	151.00	VERTICAL
50.004000	25.70	34.00	8.30		150.0	265.00	VERTICAL
57.504000	18.85	34.00	15.15		150.0	70.00	VERTICAL
64.284000	21.04	34.00	12.96		150.0	91.00	VERTICAL
86.244000	16.45	34.00	17.55		150.0	81.00	VERTICAL
92.784000	24.73	34.00	9.27		150.0	153.00	VERTICAL
100.020000	34.41	34.00	-0.41	*	150.0	174.00	VERTICAL
117.960000	26.43	34.00	7.57		150.0	27.00	VERTICAL
150.024000	20.80	34.00	13.20		150.0	164.00	HORIZONTAL
192.816000	27.38	34.00	6.62		150.0	27.00	HORIZONTAL
199.200000	23.95	34.00	10.05		150.0	114.00	HORIZONTAL
272.076000	27.81	41.00	13.19		150.0	90.00	VERTICAL
298.956000	26.48	41.00	14.52		150.0	67.00	VERTICAL
314.004000	23.78	41.00	17.22		150.0	11.00	VERTICAL
317.376000	38.48	41.00	2.52		150.0	1.00	VERTICAL
383.364000	32.15	41.00	8.85		150.0	260.00	HORIZONTAL
497.964000	33.69	41.00	7.31		150.0	338.00	VERTICAL
530.820000	34.15	41.00	6.85		150.0	315.00	HORIZONTAL
557.052000	29.74	41.00	11.26		150.0	281.00	HORIZONTAL
558.636000	24.26	41.00	16.74		150.0	122.00	HORIZONTAL
560.328000	35.81	41.00	5.19		150.0	305.00	HORIZONTAL
766.740000	38.05	41.00	2.95		150.0	200.00	VERTICAL
884.688000	35.58	41.00	5.42		150.0	163.00	VERTICAL
1000.000000	39.13	41.00	1.87		150.0	143.00	VERTICAL

Data record name: 90269_fin QP of 14.07.1999



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For frequencies above 1 GHz the values in the table above, measured in the fully anechoic chamber with the max-peak detector, are the final results.
The results from the final measurements below 1 GHz on the open area test site, at the above listed frequency points of the highest radiated emissions relativ to the limit for quasi-peak, are presented in the following.

In this case it was not necessary to carry out subsequent measurements because at no frequency was a value above the noise of the system

Result measured:
>1GHz with average detector:
(These values are marked in the above diagram by +)

Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Exceed Mark	Height	Azimuth	Polarisation
1681.400000	34.96	54.00	19.04		150.0	70.00	HORIZONTAL
1781.800000	37.95	54.00	16.05		150.0	145.00	VERTICAL
1887.300000	40.25	54.00	13.75		150.0	196.00	VERTICAL
1898.400000	40.45	54.00	13.55		150.0	159.00	HORIZONTAL

Data record name: 90269_fin AV of 14.07.1999

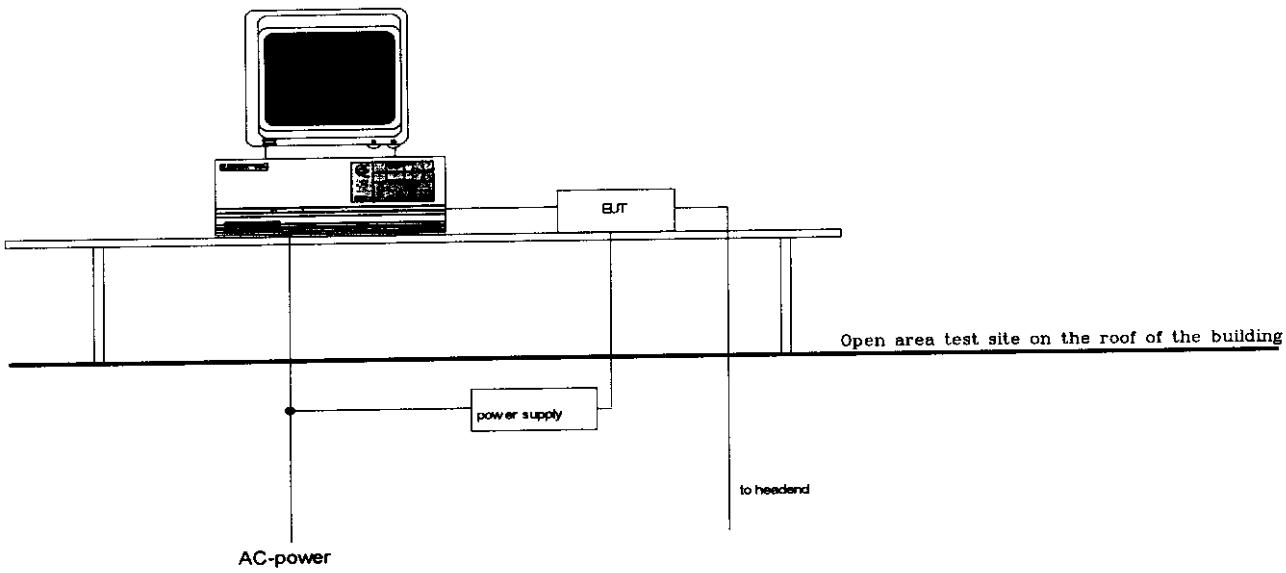
For frequencies above 1 GHz the values in the table above, measured in the fully anechoic chamber, are the final results.

3.1.2 Final Radiated Emission Measurements

The final radiated emission measurements below 1 GHz are done on the open area test site in a measurement distance of 10m.

Test set-up: In accordance to ANSI C63.4 dd. 1992. fig. 9(c) and fig. 11

The following drawing schematically shows the cable configuration for the open area test site. The MicroLink Cable is on a wooden Table on the test site. All the other equipment is inside the building under the ground plane of the open area test site.



With the results from the preliminary measurement the frequencies with the highest level, are measured with the receiver setup shown in the scan table for the search scan and with both polarization's for the antenna. In this case the turntable is moved by 2 degree steps over 360 degrees and the antenna height is changed between 1m and 4m. In the last stage the positions and frequencies with the highest levels are measured with the quasi-peak detector.

Titel	Open area test site with 10m distance
Titel	ESVS 30 test receiver by ROHDE&SCHWARZ
EUT	MicroLink Cable
Manufacturer	ELSA AG
Operating Condition	registriert and ping
Test Site	PHOENIX EMV-Test open area test site
Operator	Th. Wedeking
Test Specification	FCC Part15 with limits from CISPR 22 Class B ITE
Comment	
	14.07.99 / 12:20:19

SCANTABLE for the search scan: FCC F FF_fin

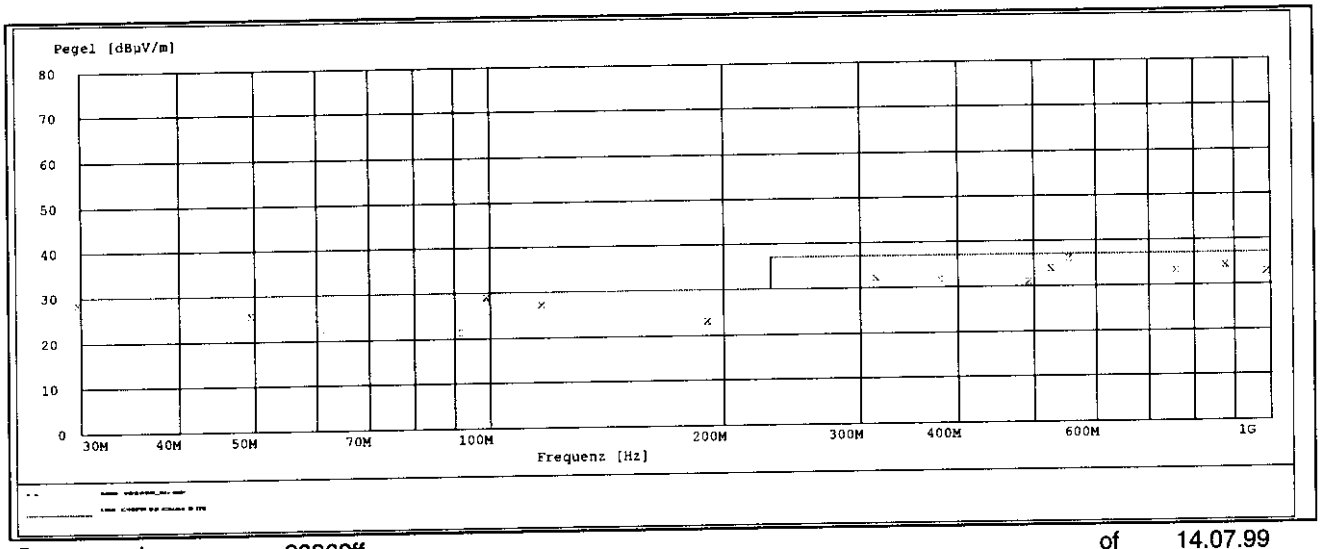
Unit:	dBµV/m	
	Detector:	Mode:
Curve1:	Average	ClearWrite
Curve2:	None	ClearWrite

Subrange 1:

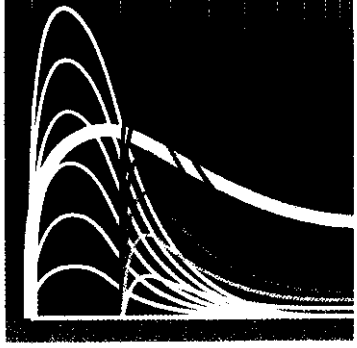
Start frequency:	30.0 MHz	Increment:	12.0 kHz
Stop frequency:	1.0 GHz		
Measurement time:	100.0 ms		
IF bandwidth:	120 kHz		
Receiver:	ESVS	Probe transducer:	_CBL 6112
Signal path:	ANT_FF ESVS	System transducer:	Transducer FF
Scan-mode:	Lin		
Tracking gen.:	Off		
Input:			
Preamplifier:	10 dB	Demodulation:	A3
RF attenuation:	10 dB		
Ref. level:			
Min. RF attenuation:	10 dB		
IF attenuation:	LowNoise		
Auto range:	Off		

The measurement time with the quasi-peak measuring detector is 1 seconds

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above mentioned standard. The measured points marked with x are the measured results of the standard subsequent measurement on the open area test site.



Data record name: 90269ff



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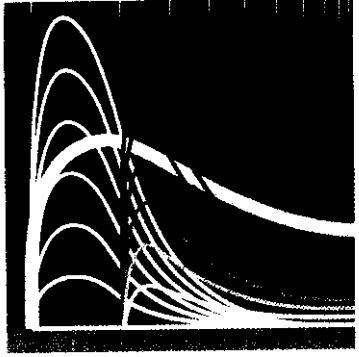
The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 10 m measuring distance.

Result measured with the quasi-peak detector:

(These values are marked in the above diagram by x)

Frequency MHz	Level dBµV/m	Transducer dB	Limit dBµV/m	Margin dB	Height	Azimuth	Polarisation
30.036000	28.50	19.9	30.0	1.5	103.0	0.00	VERTICAL
50.004000	25.70	9.5	30.0	4.3	118.0	259.00	VERTICAL
92.784000	21.50	11.2	30.0	8.5	344.0	287.00	HORIZONTAL
100.020000	29.10	12.4	30.0	0.9	110.0	174.00	VERTICAL
117.960000	27.20	13.5	30.0	2.8	250.0	358.00	VERTICAL
192.816000	23.20	10.7	30.0	6.8	103.0	67.00	VERTICAL
317.376000	32.40	15.7	37.0	4.6	103.0	0.00	VERTICAL
383.364000	32.00	17.4	37.0	5.0	250.0	200.00	HORIZONTAL
497.964000	31.20	19.8	37.0	5.8	291.0	336.00	VERTICAL
530.820000	34.10	20.3	37.0	2.9	183.0	0.00	HORIZONTAL
560.328000	36.30	21.7	37.0	0.7	151.0	290.00	HORIZONTAL
766.740000	33.40	22.8	37.0	3.6	183.0	42.00	VERTICAL
884.688000	34.50	23.4	37.0	2.5	397.0	234.00	HORIZONTAL
1000.000000	33.00	24.2	37.0	4.0	112.0	225.00	HORIZONTAL

Data record name: 90269ff_fin QP of 14.07.99



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3.2 AC Powerline Conducted Emission Test

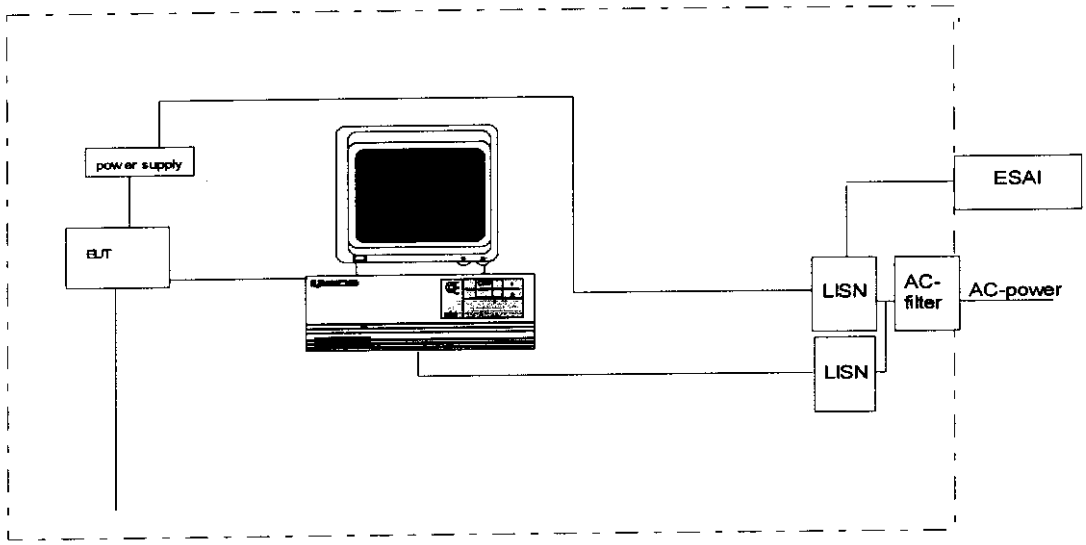
Test Equipment:	ESAI test receiver + Display (PM-Nr. 480025, PM-Nr. 480026) meets the requirements of CISPR 16 LISN NSLK 8128 (PM-Nr. 480058) meets the requirements of CISPR 16 LISN MN 2050B (PM-Nr. 480146) meets the requirements of CISPR 16 Shielded room (PM-Nr. 480088) EMI-software package ES-K1 (PM-Nr. 480111) AC-filter (PM-Nr. 480097) All measuring equipment underlie a quality system and are calibrated The test equipment is manufactured by the company Rohde & Schwarz.
Measuring records:	The measuring records are presented on the following pages.

3.2.1 Preliminary AC Powerline conducted Emission Test

Test set-up: In accordance to ANSI C63.4 dd. 1992. fig. 9(a) and fig. 11 in a shielded room.

The cable configuration is schematically shown in the following diagram

shielded room



The equipment under test is in the first step measured on one phase over the whole frequency range with the receiver setup shown in the scan table for preliminary measurements.

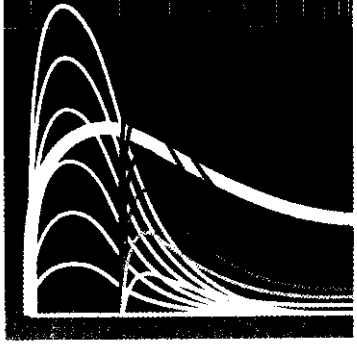
1. Heading	AC Powerline Conducted Emission Test with
2. Heading	protective ground conductor simulating network
EUT	MicroLink Cable
Manufacturer	ELSA AG
Operating Condition	registered and ping
Test Site	PHOENIX TEST-LAB Blomberg M4
Operator	Th. Wedeking
Test Specification	according to ANSI C63.4
Comment	
Start of Test	14.07.99 / 14:27:11

SCANTABLE for the preliminary measurement: FCC VolMains

Unit:	dBµV	
	Detector:	Mode:
Curve1:	MaxPeak	ClearWrite
Curve2:	Average	ClearWrite

Subrange 1:

Start frequency:	150.0 kHz	Increment:	6.0 kHz
Stop frequency:	30.0 MHz		
Measurement time:	50.0 ms		
IF bandwidth:	9 kHz		
Receiver:	ESAI	Probe transducer:	_NSLK
Signal path:	Tisch	System transducer:	SK Tisch
Scan mode:	Lin		
Tracking gen.:	Off		
Input:	1DC		
Preamplifier:	Off	Demodulation:	AM
RF attenuation:	10 dB		
Ref. level:	-50.0 dBm		
Min. RF attenuation:	10 dB		
IF attenuation:			
Auto range:	On		
Curve 1:		Repetition:	1
Curve 2:		Stop Mark:	Off
		Stop message:	Off
		Text:	



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SCANTABELLE for the subsequent measurement: FCC VolMains_fin

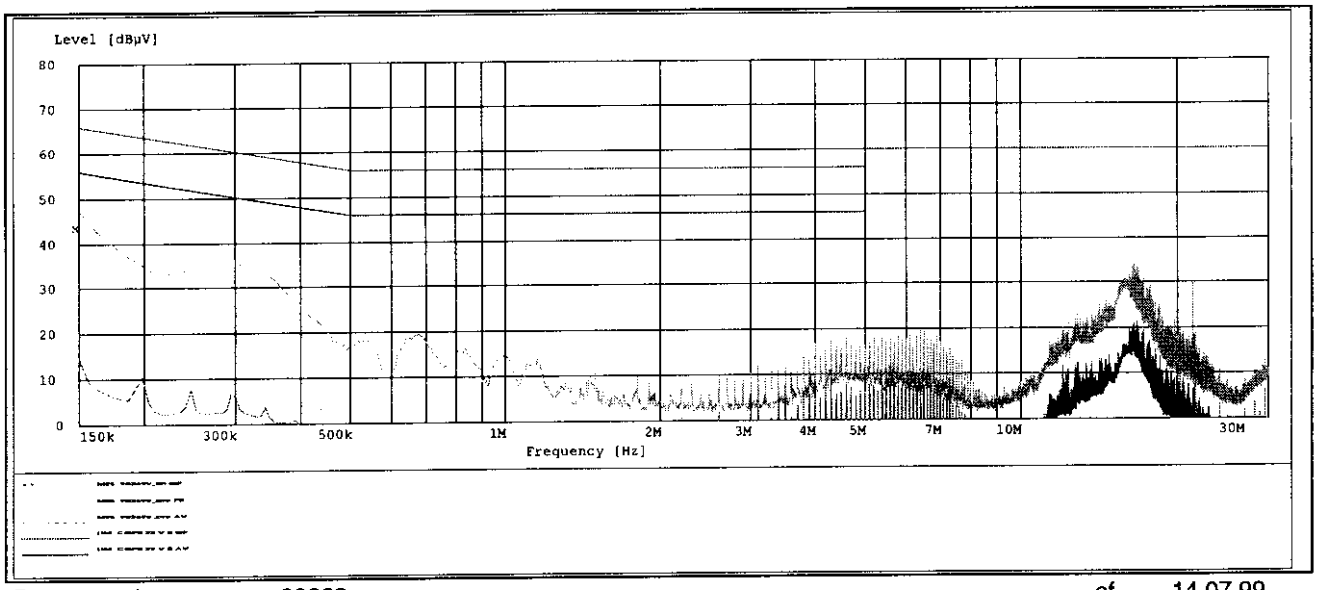
Unit:	dBµV	
	Detector:	Mode:
Curve1:	MaxPeak	ClearWrite
Curve2:	Average	ClearWrite

Subrange 1:

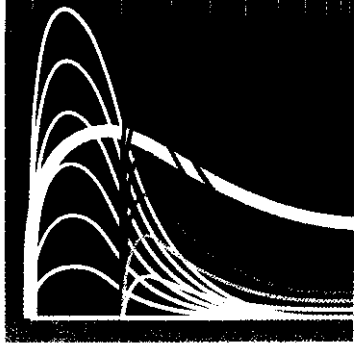
Start frequency:	150.0 kHz	Increment:	900.0 Hz
Stop frequency:	30.0 MHz		
Measurement time:	1.0 s		
IF bandwidth:	9 kHz		
Receiver:	ESAI	Probe transducer:	_NSLK
Signal path:	Tisch	System transducer:	SK Tisch
Scan mode:	Lin		
Tracking gen.:	Off		
Input:	1DC		
Preamplifier:	Off	Demodulation:	AM
RF attenuation:	10 dB		
Ref. level:	-50.0 dBm		
Min. RF attenuation:	10 dB		
IF attenuation:			
Auto range:	On		
Curve 1:		Repetition:	1
Curve 2:		Stop Mark:	Off
		Stop message:	Off
		Text:	

The measuring time with the quasi-peak measuring detector is 5 seconds

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line.
The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by x and the average measured points by +.



Data record name: 90269v of 14.07.99



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3.2.2 Final AC Powerline Conducted Emission Test

Test set-up: In accordance to ANSI C63.4 dd. 1992, fig. 9(a) and fig. 11 in a shielded room.

In the final AC powerline conducted emission test the configuration with the highest levels, closer than 20dB to the limit lines, found in the preliminary AC powerline conducted emission test are measured with the quasi-peak and the average detektor.
The measuring time with the quasi-peak measuring detector is 5 seconds

Result measured with the average detector:
(These values are marked in the above diagram by +)

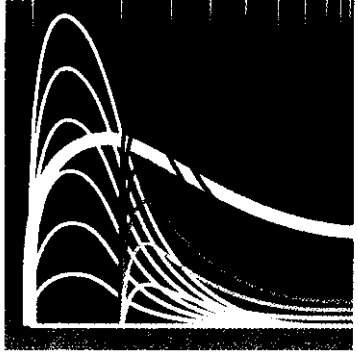
Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Exceed Mark	Phase	PE

Data record name: 90269v_fin AV of

Result measured with the quasi-peak detector:
(These values are marked in the above diagram by x)

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Exceed Mark	Phase	PE
0.150000	43.60	0.0	66.0	22.4	N	GND

Data record name: 90269v_fin QP of 14.07.99



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Annex

The annex consists of 14 pages and contains pictures of the MicroLink Cable and test set-ups:

Photo of the eut	90269eut1, 90269eut2, 90269eut3, 90269eut4 90269eut5, 90269eut6
Photos of test set-up radiated emission:	90269m8a1, 90269m8a2, 90269601, 90269602
Photos of test set-up AC Powerline Conducted Emission:	90269m4a1, 90269m4a2

Block diagram with all operating frequencies

copy of Declaration of Compliance for Packard Bell PC